

Remarks

Applicant thanks the Examiner for examining the claims of the present application. Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and the following remarks. Claims 1-21 are pending in the application. Claims 1-21 are rejected. Claims 7 and 10-17 are objected to by the Office action. No claims have been allowed. Claims 1, 10, 14, 18, and 20 are independent. Amendments have been made to claims 10-14. No new matter has been added.

Cited Art

The Office action cites US Patent No. 6,101,282 to Hirabayashi et al. ("Hirabayashi"). The Office action also cites US Patent Application No. 2003/0039396 A1 to Irvine et al. ("Irvine").

Objection to Claim 14

Claim 14 was objected to due to editorial informalities. Claim 14 is amended to read: "A computer-readable storage medium having computer-executable program instructions stored thereon, for operative upon execution in a computer media processing system to perform a method of encoding image or video data, the method comprising." (Added language underlined.) The objection to claim 14 should hereby be withdrawn.

Objection to Claims 7, 14, and 17 Under 37 C.F.R. § 1.75(a)

Claims 7, 14, and 17 are objected to under 37 C.F.R. § 1.75(a). Specifically, the Office action states that "the term 'sufficiently close' is considered narrow language and is a relative term, which renders the claim indefinite in accordance with the interpretation of the claimed subject matter." (Office Action, page 2.) Correction or clarification on the record is required.

Claim 7 provides for a method which comprises in part:

determining whether the DPCM prediction mode yielding the closer to optimal symbol distribution for entropy coding is sufficiently close to the optimal symbol distribution for entropy coding; and
if not sufficiently close, applying no DPCM to the macro-block before the entropy encoding.

Claim 14 provides for a computer-readable storage medium having computer-executable program instructions stored thereon, operative upon execution in a computer media processing system to perform a method of encoding image or video data, the method comprising in part:

if such determined DPCM prediction mode produces residuals whose distribution is sufficiently close to the optimal distribution, applying the DPCM prediction mode to the macro-block.

Claim 17 provides for a method which comprises in part:

determining whether the DPCM prediction mode producing a residual distribution closest to the optimal distribution produces a residual distribution sufficiently close to the optimal distribution; and

if not sufficiently close, RLGR entropy encoding the macro-block without applying the DPCM prediction mode to the macro-block.

The specification states, “[t]he DPCM modulator 130 chooses and applies a DPCM mode for the current MB that more optimally decorrelates the MB to produce DPCM residuals that compress better with RLGR entropy coding. The RLGR entropy coding achieves its best coding performance when its input values have a zero-biased, two-sided Laplacian distribution.” (Page 8, lines 2-5.) The specification continues:

The DPCM modulator checks which prediction mode produced residuals having a distribution closest to the ideal distribution for RLGR entropy encoding. The DPCM modulator further checks whether this closest distribution is sufficiently close to the ideal zero-biased, two-sided Laplacian distribution. The DPCM modulator chooses the DPCM prediction mode with the closest-to-ideal distribution for the macro block, unless the sufficiency threshold is not met. (Page 9, lines 21-26.)

Thus, the term “sufficiently close” as used in claims 7, 14, and 17 is used to mean “sufficiently close for entropy encoding.” As such, one of ordinary skill in the art would recognize the requisite degree of closeness required, and thereby be reasonably apprised of the scope of the invention.

For at least these reasons, claims 7, 14, and 17 particularly point out and distinctly claim the subject matter which the Applicant regards as his invention or discovery. As such, the objection to claims 7, 14, and 17 under 37 C.F.R. § 1.75(a) should be withdrawn.

Objection to Claims 10-17 Under 37 C.F.R. § 1.75(a)

Claims 10-17 are objected to by the Office action for allegedly reciting a “system” in the preamble of the claims without reciting structure in the body of the claims. The action states that a computer-implemented product is assumed for examination purposes. (Office action, page 3.)

Claim 10 has been amended to provide for:

A computer-implemented media system providing predictive lossless coding of image or video media content, the system comprising a computer comprising one or more computer-readable media and a processor, the computer-readable media containing instructions, which, when executed by the processor on the computer, cause the computer to perform the actions of. (Added language underlined.)

Thus claim 10 as amended clearly provides for the apparatus of a computer-implemented media system which performs a series of actions. Claims 11-13 depend from independent claim 10 and recite similar language in the preamble.

Claim 14 as amended teaches:

A computer-readable storage medium having computer-executable program instructions stored thereon, ~~for~~ operative upon execution in a computer media processing system to perform a method of encoding image or video data.

Thus, claim 14 teaches the product of a computer-readable storage medium with instructions which, when executed, perform a given method. Claims 15-17 depend from independent claim 14 and recite similar language in the preamble.

For at least these reasons, claims 10-17 particularly point out and distinctly claim the subject matter which the Applicant regards as his invention or discovery. As such, the objection to claims 10-17 under 37 C.F.R. § 1.75(a) should be withdrawn.

Rejection of Claims 10-17 Under 35 U.S.C. § 101

Claims 10-17 are rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. (Office action, page 4.) Specifically, the Office action alleges that “the claim does not define a computer-readable medium or memory and is thus non-statutory for that reason.” (Id.)

Claim 10 is amended to embody the program on a computer-readable medium. As such, claim 10, as well as claims 11-13, which depend from claim 10, recite statutory subject matter and Applicant requests that the rejection of claims 10-13 under 35 U.S.C. § 101 be withdrawn.

Claim 14 recites “[a] computer-readable storage medium having computer-executable program instructions stored thereon, operative upon execution in a computer media processing system to perform a method of encoding image or video data” and is thus statutory. MPEP Guidelines Annex IV state: “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized.” As such, claim 14 as well as claims 15-17, which depend from claim 14, recite statutory subject matter and Applicant requests that the rejection of claims 14-17 under 35 U.S.C. § 101 be withdrawn.

Rejections Under 35 U.S.C. § 102(b)

Claims 1, 3-10, and 12-17 are all rejected under 35 U.S.C. § 102(b) as anticipated by Hirabayashi. Applicant traverses the rejections.

Claim 1

Claim 1 provides for a method for lossless coding of image and video media, comprising in part: “applying the selected DPCM prediction mode to the block portion; and entropy encoding DPCM residuals of the block portion.” Hirabayashi does not teach entropy encoding DPCM residuals of the block portion.

The application describes that the DPCM predictions are “designed to optimally decorrelate image data from photographic as well as graphics sources . . . [and] also designed to produce residuals that have zero biased, two-sided Laplacian distributions, as these are best coded by the run-length Golomb Rice (RLGR) entropy coding method.” (Page 3, lines 7-16.) The application specifies that DPCM residuals are “[t]he difference obtained from subtracting a pixel’s actual value from its predicted value.” (Page 8, lines 15 and 16.) The application further states that “[the] DPCM mode and DPCM residuals produced by the DPCM modulator 130 are then entropy encoded using RLGR coding in the RLGR entropy encoder 140.” (Page 10, lines 16-18.)

Hirabayashi, by contrast, does not teach or suggest entropy encoding DPCM residuals. At no point does Hirabayashi even suggest the existence of residuals acquired by applying a selected DPCM prediction mode to a block portion.

Additionally, Hirabayashi does state in col. 3, lines 40-44 that there are nine different encoding methods which may be used. However, Hirabayashi then states:

The encoding target block (or the block dividing method) is tentatively determined, based on the comparison of the amount of codes generated by encoding of a square block and the total amount of codes generated by encoding four sub blocks formed by dividing the above-mentioned square block into four. (Col. 5, lines 60-65.)

Hirabayashi then continues:

Through the comparison of the amount of codes of a square block and the total amount of codes of the sub blocks thereof according to the foregoing equations, there is selected a block size providing the smaller amount of codes, and, if the sub blocks are selected, the selection of the block size is conducted for each of such sub blocks, in place of the above-mentioned square block. **The amount of codes for each block is calculated with an encoding method best matching the block, among the nine encoding methods.** (Col. 6, lines 40-48, emphasis added.)

Thus, Hirabayashi's use of multiple encoding methods does not lead to "entropy encoding DPCM residuals of the block portion," as recited by claim 1.

Thus, Hirabayashi does not teach or suggest each and every element of claim 1. Additionally, each of claims 3-9, which depend from claim 1, recite additional patentable language. Thus, Applicants respectfully note that claim 1 and its dependent claims 3-9 are allowable and request the allowance of claims 3-9.

Claim 10

Claim 10 provides in part for:

a multi-mode differential pulse code modulation (DPCM) process operating on an individual macro-block of the input image data to choose one of multiple DPCM prediction modes that produces a residual distribution for the macro-block to more closely match an optimal run-length, Golomb-Rice (RLGR) entropy coding distribution, and applies the chosen DPCM prediction mode to the macro-block; and

an entropy coding process for performing a run-length, Golomb-Rice coding of the DPCM residuals of the macro-block.

As described above, Hirabayashi does not teach or suggest entropy encoding residuals of applications of DPCM prediction modes to a given macro-block. The Office action alleges that Hirabayashi teaches an entropy coding process for performing a run-length, Golomb-Rice coding of the DPCM residuals of the macro block at col. 10, line 12. (Office action, page 9.)

Hirabayashi describes at the referenced portion:

In the embodiment explained above, the Huffman encoding may be replaced by other entropy encoding methods such as arithmetic encoding. Also, the encoding may be conducted, instead of the difference between the pixels, on the run-lengths of the pixel values. (Col. 10, lines 10-13.)

The “difference between the pixels” is explained as:

The difference generating circuit 102 generates, for each of the 8x8 pixels in the block, the difference from a pixel adjacent to the left, and stores thus generated 8x8 differences in the buffer 112. Similarly, the difference generating circuit 103 generates, for each of the 8x8 pixels in the block, the difference from a pixel positioned thereon and stores thus generated 8x8 differences in the buffer 113.

The Huffman encoder 104 effects Huffman encoding of the difference data trains stored in the buffers 112, 113. (Col. 9, lines 19-28.)

Thus, the “difference between the pixels” that is being Huffman encoded is a train of the difference of a current pixel against the pixel either immediately to its left or above it. The purpose of creating these tables is that the Huffman encoder predicts “whether the difference generating circuit 102 or 103 generates a smaller amount of codes, and the difference calculating mode, or the method of calculating the difference between the pixels, is determined according to the result of such prediction.” (Col. 10, lines 25-29.)

Thus the cited portion of Hirabayashi is different from entropy encoding the DPCM **residuals** of the macro-block as is recited in claim 10. As such, Hirabayashi does not teach or suggest each and every element of claim 10. Additionally, each of claims 12 and 13, which depend from claim 10, recites additional patentable language. Thus, Applicants respectfully note that claim 10 and its dependent claims 12 and 13 are allowable and request such action.

Claim 14

Claim 14 provides in part for:

- converting image data to a YCoCg color space format;
- splitting the image data into macro-blocks;
- for a macro-block of the image data, determining which from a group of available DPCM prediction modes produces residuals closest to an optimal distribution for RLGR coding;
- if such determined DPCM prediction mode produces residuals whose distribution is sufficiently close to the optimal distribution, applying the DPCM prediction mode to the macro-block; and
- RLGR entropy encoding the residuals of the macro-block.

As noted above, Hirabayashi does not teach or suggest entropy encoding residuals resulting from the application of a DPCM prediction mode to a macro-block. Additionally, as the Office action notes, Hirabayashi does not teach or suggest converting the input image data into a YCoCg color space format (Office action, page 13.) As such, Hirabayashi does not teach or suggest each and every element of claim 14. Additionally, each of claims 15-17, which depend from claim 14, recite additional patentable language. Thus, Applicants respectfully note that claim 14 and its dependent claim 15-17 are allowable and request the allowance of claims 15-17.

Rejections Under 35 U.S.C. § 103(a)

Claims 2, 11, 18, and 19 are all rejected under 35 U.S.C. § 103(a) as unpatentable over Hirabayashi in view of Irvine. Applicant traverses the rejections.

Claim 2

The Office action rejects dependent claim 2 as unpatentable over Hirabayashi in view of Irvine. (Office action, page 14.) Dependent claim 2 reads upon independent claim 1 which recites, in part:

- for an individual one of the block portions, selecting one of multiple available differential pulse code modulation (DPCM) prediction modes to apply to the block portion that out of the available DPCM prediction modes yields a closer to optimal symbol distribution of an entropy encoder;
- applying the selected DPCM prediction mode to the block portion; and
- entropy encoding DPCM residuals of the block portion.

As discussed above, the application describes that the DPCM predictions are “designed to optimally decorrelate image data from photographic as well as graphics sources . . . [and] also designed to produce residuals that have zero biased, two-sided Laplacian distributions, as these are best coded by the run-length Golomb Rice (RLGR) entropy coding method.” (Page 3, lines 7-16.) The application specifies that DPCM residuals are “[t]he difference obtained from subtracting a pixel’s actual value from its predicted value.” (Page 8, lines 15 and 16.) The application further states that “[the] DPCM mode and DPCM residuals produced by the DPCM modulator 130 are then entropy encoded using RLGR coding in the RLGR entropy encoder 140.” (Page 10, lines 16-18.) As discussed above, Hirabayashi does not teach or suggest entropy encoding DPCM residuals.

Irvine does not cure this deficiency in Hirabayashi. Irvine states:

The system is hybrid – meaning that it has a part that compresses the said data in a lossy manner and a part that compresses the residual data in a lossless fashion. For the lossy part, the system uses the adaptive block size discrete cosine transform (ABSDCT) algorithm. . . . **A residual image is obtained as the difference between the original and the decompressed one from the ABSDCT system.** This residual is encoded losslessly using Golomb-Rice coding algorithm. (Irvine, paragraph 0019, emphasis added.)

The residuals of the Irvine method are not the residuals obtained after application of a DPCM prediction mode as is taught by claim 1. Irvine, then, does not teach or suggest “entropy encoding of DPCM residuals of the block portion” as recited in claim 1. Thus Hirabayashi and Irvine, whether considered separately or in combination with each other, do not teach each or suggest and every element of independent claim 1, and accordingly do not teach or suggest each and every element of dependent claim 2.

Claim 11

Claim 11 is rejected as unpatentable over Hirabayashi in view of Irvine. (Office action, page 14.) Claim 11 depends from independent claim 10 which recites in part, “an entropy coding process for performing a run-length, Golomb-Rice coding of the DPCM residuals of the macro-block.” As discussed above, Hirabayashi does not teach or suggest entropy encoding DPCM residuals as recited by claim 10. Irvine does not cure the deficiency of Hirabayashi, as the entropy encoding of residuals as discussed in Irvine is different from encoding a DPCM

residual of a macro-block for the reasons stated above with respect to claim 2. Thus, Hirabayashi and Irvine, whether considered separately or in combination with each other, do not teach each and every element of independent claim 10, and accordingly do not teach each and every element of dependent claim 11.

Claim 18

Claim 18 is rejected as unpatentable over Hirabayashi in view of Irvine. (Office action, page 15.) Claim 18 recites a method of decoding predictive losslessly coded data of an image or video, comprising in part “RLGR entropy decoding a macro-block mode, a DPCM prediction mode and DPCM residuals for each of a plurality of macro-blocks using separate RLGR coding contexts.”

The application states:

The RLGR entropy encoder 140 in the illustrated PLC-based encoder **uses a separate RLGR context for each of:** a) the MB mode (flat or not); b) the DPCM mode; c) the DPCM residual values (zero biased two-sided Laplacian distributions of integers). In each of these contexts, the RLGR entropy encoder performs an adaptive run-length/Golomb-Rice binary encoding of the binary string formed by the significant bits that come from the symbols being coded by the separate context . . . The use of multiple RLGR contexts to code different symbol distributions improves the entropy coding performance. (Page 11, lines 3-10, emphasis added.)

The application then states that:

[A]n image decoder 600 based on predictive lossless coding (PLC) performs decoding of the output bitstream 195 produced from PLC-coding by the PLC-based image encoder 100. In this PLC-based image decoder 600, a bitstream demultiplexer 610 first separates out individual encoded MBs in the bitstream, and the encoded MB mode, the DPCM mode and DPCM residuals for that MB. The bitstream demultiplexer provides the separate data to an RLGR decoder 620.

The RLGR decoder 620 decodes the RLGR-encoded MB mode, DPCM mode and DPCM residuals for each MB. (Page 12, lines 4-11.)

Thus, the application clearly describes that the term “context” applies to the RLGR encoding and decoding of the MB mode, the DPCM mode, and the DPCM residual values occurring independently from each other.

The Office action states that Hirabayashi does not teach “RLGR entropy decoding a macro-block mode, a DPCM prediction mode and DPCM residuals for each of a plurality of macro-blocks using separate RLGR coding contexts.” (Office action, page 13.) Irvine does not cure the deficiencies of Hirabayashi.

As discussed above, the residuals or Irvine are not the same as the residuals that result from the use of a DPCM prediction mode, and therefore Irvine does not teach or suggest decoding DPCM prediction residuals as recited by claim 18.

Additionally, Irvine states that “[u]pon gathering of a frame’s worth of data, a subtractor 966 compares the stored frame 964 with a next frame 968. In an alternate embodiment the subtractor 966 compares on a block by block basis.” (Paragraph 0100.) Comparing data on a page by page or block by block basis is not the same as encoding different modes or the residuals thereof within a single macro-block “using separate RLGR coding contexts,” as described in claim 18. Thus, Hirabayashi and Irvine, whether considered separately or in combination with each other, do not teach or suggest each and every element of claim 18. As such, claim 18 and its dependent claim 19 are allowable and Applicant respectfully requests withdrawal of the § 103 rejection.

Claim 20

Claim 20 is rejected as unpatentable over Hirabayashi in view of Irvine. (Office action, page 16.) Claim 20 recites a predictive-lossless coded image or video decoder, comprising in part “a run-length Golomb-Rice (RLGR) entropy decoder operating to decode RLGR-encoded DPCM residuals and DPCM prediction mode of a macro-block.”

The Office action states that Hirabayashi does not teach “a predictive-lossless coded image or video decoder, comprising: a run-length Golomb-Rice (RLGR) entropy decoder operating to decode RLGR-encoded DPCM residuals and DPCM prediction mode of a macro-block.” (Office action, page 14.) Irvine does not cure this deficiency of Hirabayashi. As discussed above, Irvine does not teach or suggest “decod[ing] RLGR-encoded DPCM residuals,” as recited by claim 20.

Thus, Hirabayashi and Irvine, whether considered separately or in combination with each other, do not teach or suggest each and every element of claim 20. As such, claim 20 and its dependent claim 21 are allowable and Applicant respectfully requests withdrawal of the § 103 rejection.

Request for Information Disclosure Statements to Be Reviewed

Applicants note that the Action does not include an initialed copy of the Form 1449 which accompanied an Information Disclosure Statement filed on September 29, 2005. In addition, the Action does not include a fully-considered copy of the Form 1449 which accompanied an Information Disclosure Statement filed on June 9, 2005. Applicants request the Examiner provide an initialed copy of both of these Form 1449's.

Request for Interview

If any issues remain, the Examiner is formally requested to contact the undersigned attorney prior to issuance of the next office Action in order to arrange a telephonic interview. It is believed that a brief discussion of the merits of the present application may expedite prosecution. Applicants submit the foregoing formal Amendment so that the Examiner may fully evaluate Applicants' position, thereby enabling the interview to be more focused.

This request is being submitted under MPEP § 713.01, which indicates that an interview may be arranged in advance by a written request.

Conclusion

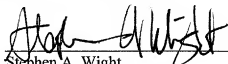
The claims in their present form are allowable. Such action is respectfully requested.

Respectfully submitted,

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